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REMARKS

The application has been reviewed in light of the Office Action dated April 7, 2008. Claims 1-17 are pending. By this Amendment, claim 1 has been amended to clarify the claimed subject matter thereof. Accordingly, claims 1-17 are presented for reconsideration, with claims 1-3 being in independent form.

Claims 1-17 were rejected under 35 U.S.C. § 102(b) as purportedly anticipated by Kusunoki et al. (WO 03/026897 A1).

The present application relates to improvements devised by applicant to driving control of an ejection head in an image reproducing and forming apparatus. In particular, a driving signal generating unit configured to generate a driving waveform, and portions of the driving waveform are selected for producing a driving signal. For example, two or more portions of the driving waveform are used to produce a non-ejecting pulse. Each of independent claims 1-3 addresses such features, as well as additional features.

Tables 2, 4 and 5 of the present application show examples wherein two or more portions of the driving waveform are used to produce a non-ejecting pulse. In the example of Table 2, portions S1 and S7 are used to form a non-ejecting pulse. In the example of Table 4, portions S1 and S4 are used to form a non-ejecting pulse. In the example of Table 5, portions S1 and S6 are used to form a non-ejecting pulse.

In contrast, Kusunoki does not disclose or suggest using two or more portions of the driving waveform to produce a non-ejecting pulse.

The Office Action cited Figs. 15-18 of Kusunoki. Figs. 15 and 16 (reproduced below) of Kusunoki correspond to a fourth embodiment proposed in Kusunoki (see Kusunoki, page 14, lines 12-15):

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FIG.15

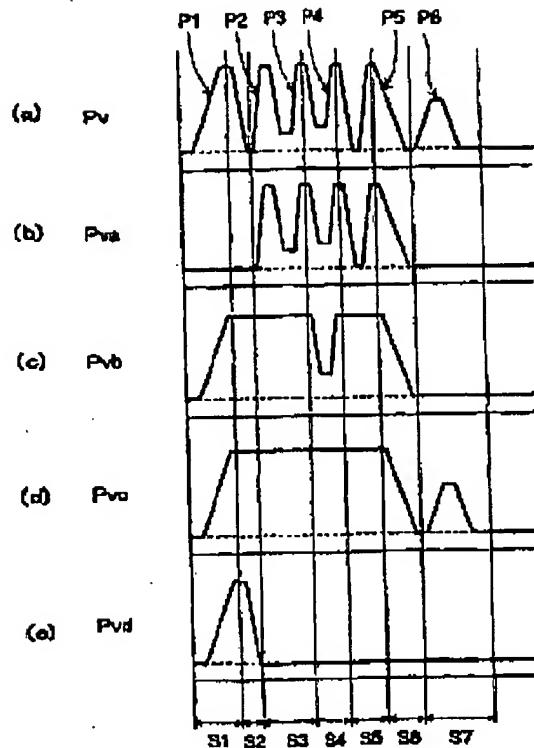


FIG.16

	S1	S2	S3	S4	S5	S6	S7
Mj1 (LARGE)	0	0	1	1	1	1	0
Mj2 (MEDIUM)	1	0	0	1	0	1	0
Mj3 (SMALL)	1	0	0	0	0	1	1
NON-DISCHARGE DRIVING	1	0	0	0	0	0	0

In the embodiment corresponding to Figs. 15 and 16 of Kusunoki, the driving waveform has portions S1-S7. As shown in Fig. 16, in non-discharge driving, only one portion (S1) of the driving waveform is used for the non-discharge driving signal.

Figs. 17 and 18 (reproduced below) of Kusunoki correspond to a different, fifth

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embodiment (see Kusunoki, page 14, lines 16-19):

FIG.17

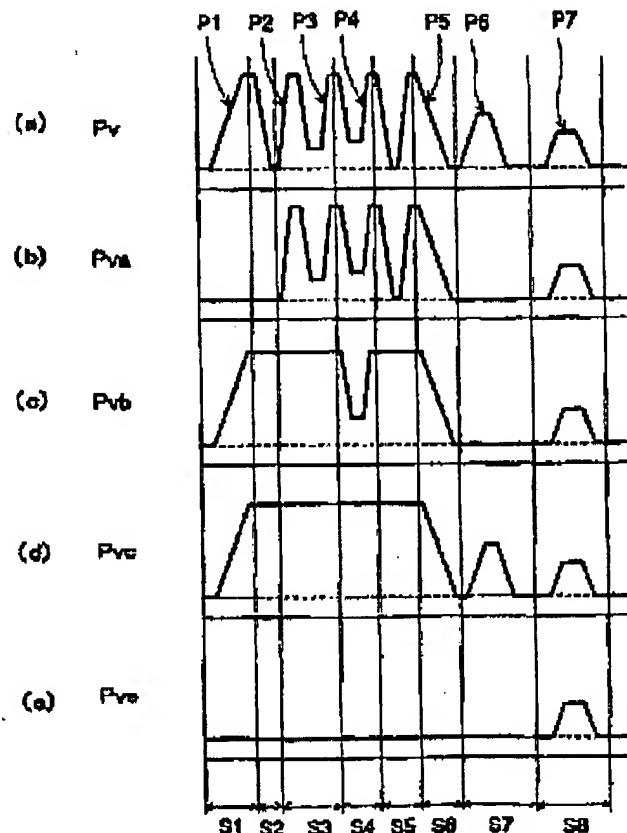


FIG.18

	S1	S2	S3	S4	S5	S6	S7	S8
Mj1 (LARGE)	0	0	1	1	1	1	0	1
Mj2 (MEDIUM)	1	0	0	1	0	1	0	1
Mj3 (SMALL)	1	0	0	0	0	1	1	1
NON-DISCHARGE DRIVING	0	0	0	0	0	0	0	1

In the embodiment corresponding to Figs. 17 and 18 of Kusunoki, the driving waveform has portions S1-S8. As shown in Fig. 18, in non-discharge driving, only one portion (S8) of the

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driving waveform is used for the non-discharge driving signal.

Kusunoki simply does not disclose or suggest using two or more portions of the driving waveform to produce a non-ejecting pulse.

Accordingly, independent claims 1-3 of the present application, and the claims depending therefrom, are submitted to be allowable over the cited art.

In addition, claim 2 is allowable also because the cited art does not disclose or suggest the driving waveform includes first and second dummy pulses, and the driving signal generating unit produces the non-ejecting pulse making use of a portion of the first dummy pulse and a portion of the second dummy pulse. Such feature is present in the example of Table 2 of the present application wherein S1 corresponds to one dummy pulse and S7 corresponds to a second dummy pulse.

Fig. 10 of Kusunoki does not correspond to a non-ejecting pulse making use of a portion of the first dummy pulse and a portion of the second dummy pulse.

As indicated in Kusunoki, page 27, line 8 through page 28, line 13, Fig. 10 shows a driving waveform having waveform elements a-e that is applied as a driving signal to a piezoelectric vibrator to cause a droplet to be discharged. Stated another way, Fig. 10 shows an ejecting pulse.

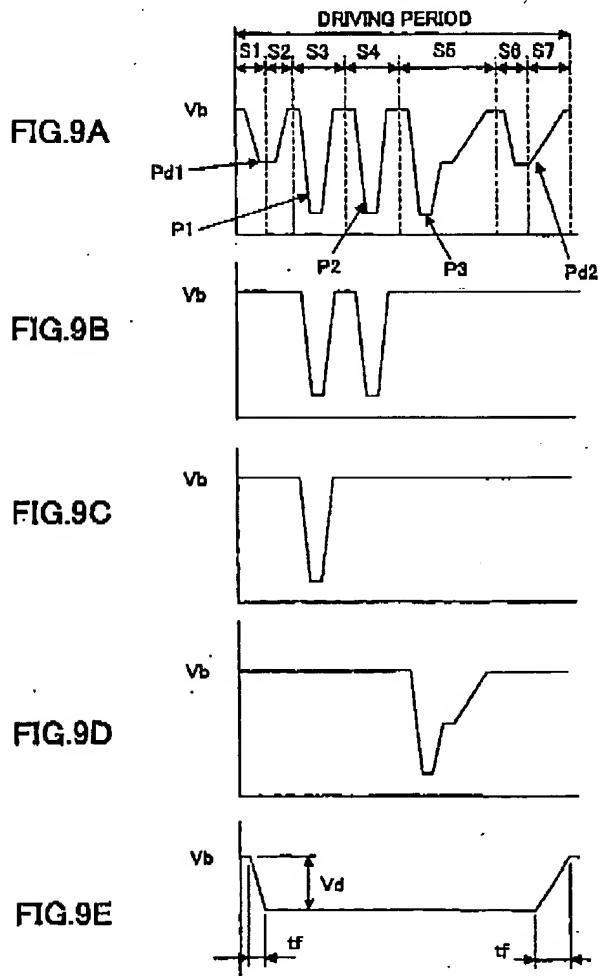
Further, claim 3 is allowable also because the cited art does not disclose or suggest the driving waveform includes a dummy pulse and the driving signal generating unit produces the non-ejecting pulse, making use of a portion of the dummy pulse and a portion of the ejecting pulse.

As mentioned above, Fig. 10 and page 27, line 8 through page 28, line 13 clearly propose an ejecting pulse.

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In addition, claim 1 is allowable also because the cited art does not disclose or suggest that the non-ejecting pulse has a pulse width greater than that of the ejecting pulse, while producing energy for not ejecting the droplet. The feature is clearly shown in Fig. 9E of the present application. Figs. 9A-9E of the present application are reproduced below. Fig. 9A shows a driving waveform with portions S1-S7, Figs. 9B-9D show ejecting pulses produced by selecting portions of the driving waveform and Fig. 9E shows a non-ejecting pulse produced by selecting portions S1 and S7 of the driving waveform (see Table 2).



The width of the non-ejecting pulse shown in Fig. 9E is clearly wider than the widths of

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the ejecting pulses shown in Figs. 9B-9D.

Regarding paragraphs [0015], [0081], [0088] and [0099] (reproduced below) of the present application, applicant respectfully submits that the contention in the Office Action regarding the desired size of the non-ejecting pulse is based on a misunderstanding of these paragraphs.

[0015] Alternatively, the non-ejecting pulse may be a pulse that pushes out the nozzle meniscus. In this case, it is preferable that the width-of-the non-ejecting pulse is smaller than the period of pressure-induced resonance in the liquid chamber of the ejection head.

[0081] When the non-ejecting pulse shown in FIG. 9E is applied, it is required not to eject an ink droplet. Accordingly, the flat voltage V_d after the voltage drop from V_b is set to a level not causing an ink droplet to be ejected, or alternatively, the slopes of the falling edge or the rising edge of the pulse are set gentle by appropriately selecting the time constant of fall and the time constant of rise. In view of the purpose of driving the inkjet head at a frequency other than the natural frequency, it is effective to set the non-ejecting voltage V_d large and to set the slopes of the falling edge and the rising edge gentle. However, if the slope is set gentle, the pulse width of the dummy signal becomes large, and the driving period becomes long. This results in a decreased printing rate, and therefore, it is not desired to set the pulse slope gentle more than is needed.

[0088] It is preferable that the pulse width of the non-ejecting pulse P_e shown in FIG. 11E be shorter than the period of the pressure-induced resonance in the pressure chamber 46. The period of pressure-induced resonance is a wave period of the pressure wave produced in the pressure chamber 46 when a stepwise voltage signal is applied to the piezoelectric element 52.

[0099] In other words, the non-ejecting pulse P_e includes the first pulse that pushes out the ink meniscus on the nozzle surface and the second pulse that follows the first pulse to pull in the meniscus. The pulse width of the first pulse is shorter than the period of the pressure-induced resonance in the pressure chamber, as has been explained above. In short, the non-ejecting pulse shown in FIG. 14E achieves an excitation effect with an improved pulse swing, while removing the adverse effect of resonance on the printed image quality efficiently. At the same time, the influence of undesirable ink mist that adheres to the nozzle surface during the continued printing operation can be removed. As a result, ejection of ink droplets can be performed in a stable manner.

Thus, paragraphs [0015], [0088] and [0099] of the present application merely points out

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that it is desirable for the non-ejecting pulse to have a pulse width smaller than a period of pressure-induced resonance in a liquid chamber of the ejection head.

The application says nothing about the non-ejecting pulse having a width smaller than the width of an ejecting pulse. Indeed, as pointed out above, the non-ejecting pulse, which is produced by using two portion of the driving waveform from opposite ends of the waveform (see claim 9 of the present application), shown in Fig. 9E of the present application clearly is much wider than the non-ejecting pulses shown in Figs. 9B-9D.

On the other hand, the apparatus proposed by Kusunoki does not output a non-ejecting pulse having a pulse width greater than that of the ejecting pulse.

In view of the remarks hereinabove, Applicant submits that the application is now in condition for allowance, and earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any fees that are required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,



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